US Environmental Protection Agency Great Lakes Restoration Initiative (GLRI) 2013 Great Lakes Shoreline Cities Green Infrastructure Grants

Project Applicant:

City of Milwaukee

Project Title:

Milwaukee's Greenscape - Green Alleys, Porous Walks and

Stormwater Parking

Project Lead:

Environmental Policy Analyst

City of Milwaukee DPW - Operations

841 N. Broadway, Room 619

Milwaukee, WI 53202

Federal Funding Request:

\$1,000,000

Recipient of Funds:

City of Milwaukee – Department of Public Works

841 N. Broadway, Room 619

Milwaukee, WI 53202

Project Duration:

January 1, 2014 - December 31, 2014

Narrative Statement

The City of Milwaukee proposes Milwaukee's Greenscape – Green Alleys, Porous Walks and Stormwater Parking to install \$1,000,000 in green infrastructure to deliver Great Lakes protection. Funding from the US Environmental Protection Agency Great Lakes Restoration Initiative (GLRI) Great Lakes Shoreline Cities Green Infrastructure Grants will prevent polluted stormwater runoff from further impairing Milwaukee's waterways. The City will install approximately 28,865 ft² of porous pavement through green alleys, porous sidewalks and a stormwater parking lot to capture 502,929 gallons of stormwater runoff. These projects build on and strengthen Milwaukee's efforts to reduce polluted stormwater runoff from entering local rivers and protecting the health and vitality of Lake Michigan. Milwaukee's Greenscape is consistent with the City's strategic planning efforts around green infrastructure and environmental sustainability.

The <u>City of Milwaukee</u> and the <u>Milwaukee Metropolitan Sewerage District (MMSD)</u> are leaders in the implementation of green infrastructure to improve Great Lakes water quality. In 2011, the City of Milwaukee and MMSD won the Leadership in Stormwater Management Award from the <u>Great Lakes and St. Lawrence (GLSL) Cities Initiative</u> for a combined commitment to green infrastructure. The City's history of green infrastructure includes green roofs on city facilities, growing the city's tree canopy, installing bioretention on city medians and between the street and sidewalk, disconnecting residential downspouts, installing rain gardens on private property and recent green alley and porous sidewalk pilot projects. MMSD won the <u>2012 United States Water Prize</u> for fostering watershed-based solutions to achieve water sustainability. These awards highlight the City's ability to plan and implement green infrastructure and to form effective partnerships among public, private, non-governmental and community organizations.

Recent City and regional planning efforts have coordinated to plan for implementation of green infrastructure. In March 2013, the City of Milwaukee completed its Green Streets Stormwater Management Plan to systematically review street and alley reconstruction projects for green infrastructure opportunities. Through implementation of this plan, the City will be able to costeffectively install green infrastructure to take advantage of cost-efficiencies available during reconstruction as streets, alleys, curbs and sidewalks are being replaced. Integrating green infrastructure into the initial planning and design process provides a 20%-40% cost savings over green retrofits. In July 2013, MMSD approved their Regional Green Infrastructure Plan that recommends adding 740 million gallons of green infrastructure capacity by 2035. Milwaukee is one of 28 communities within MMSD's service area and the City's highly visible, pace-setting projects are an important step toward achieving the 740 million gallon goal. As stated in the plan, "funding construction and maintenance [of green infrastructure] is a critical success factor" and GLRI funding will advance the City's leadership on green infrastructure within the MMSD service territory. Finally, the City unveiled ReFresh Milwaukee, the City of Milwaukee Sustainability Plan which sets aggressive goals across the water-issue spectrum by implementing a vision for a comprehensive green infrastructure program. ReFresh Milwaukee was developed with broad public engagement that included public surveys, focus groups and trade association input. MMSD's Regional Green Infrastructure Plan also had

a lengthy public comment period indicating green infrastructure is generally accepted and desired in the community.

Milwaukee's Greenscape is consistent with these planning efforts and will demonstrate measureable progress toward local stormwater capture and green infrastructure goals. The proposed projects exceed requirements as the City is not under enforcement order and the City's Wisconsin Pollutant Discharge Elimination System (WPDES) permit does not require green infrastructure, nor will these projects be applied toward MMSD's 1M gallon annual permit goal. The City's leadership on Milwaukee's Greenscape will serve as a model for the other 27 municipalities served by MMSD, making the results replicable and extending protection of Lake Michigan beyond city limits.

As required, the City will submit a final report on the outcomes of the grant-funded work. The final report will include metrics on the number of green infrastructure measures installed, site locations with photographs, stormwater capture in gallons, reductions in pollutant loads and co-benefits of the projects. The report will also discuss outreach and education performed by the City and its partners.

Green Alleys

The City funds an annual alley reconstruction program that replaces residential alleys based on pavement condition and age. This program installs an average of 25 alleys per year. *Milwaukee's Greenscape* will replace and install approximately 7 green alleys using porous pavement. The City has successfully modeled an innovative, cost-effective approach to green alleys that maximizes stormwater capture by using both porous and conventional pavements. The City installed a green alley at South Lawn Housing Development located at 3350 S. 25th Street, outside the combined sewer area, that installed a 4 feet wide lane of porous pavement in the center of the alley. The remaining 8 feet of alley on either side was reconstructed using conventional



Milwaukee's Model Green Alley

pavement. This approach maximized existing design practices that grade alleys to drain stormwater runoff to the center of the alley where it traditionally flows into sewer inlets. In this case, stormwater runoff flows off the conventional pavement and drains to the porous pavement and infiltrates through the underlying gravel layer that filters pollutants. This model reduces the cost of porous pavement which is typically 2-3 times more expensive than conventional pavement by using it only in drainage-critical areas. The targeted use of porous pavement for the center 4 feet of alley is a model practice that, once proven on other sites citywide, can be replicated by other cities to reduce the cost of porous pavement and make green alleys more cost-effective.

Milwaukee's Greenscape proposes to replicate this model and install up to 7 green alleys. In 2014, the City's alley program will reconstruct and replace a total of 32 alleys. This project targets installation of porous pavement in 7 of the 32 alleys for a total of 22,340 ft² of porous pavement draining a total of 105,825 ft² of area. Review of the 2014 alley program was conducted using the Green Streets

Stormwater Management Plan to identify candidates for porous pavement. The Green Streets Stormwater Management Plan incorporates screening checkpoints into the planning process to note where green infrastructure opportunities exist and what green infrastructure options are suitable based on project parameters. Alleys provide an excellent opportunity for porous pavement given limited available space. Green alley selection was further prioritized by location within the separate storm sewer system and stormwater capture potential to deliver the greatest water quality benefits. Green alleys at these locations will collect and filter polluted stormwater runoff that otherwise drains to the nearest water body and eventually into Lake Michigan.

Milwaukee's Greenscape Green Alleys include:

Alley Location	Porous Pavement Area (ft²)	Alley Drainage Area (ft²)	Storage Volume (Gallons)	Sewer System	Water Body	Pollutant Removal
W. Cleveland Av, W. Freemont Pl, S. 63 rd St, S. 67 th St	4,400	22,000	98,736	Separate	Lyons Park Creek (to Kinnickinnic River)	TSS, P, N
W. Capitol Dr, W. Hope Av, N. 24 th Pl, N. 25 th St	4,400	19,800	88,862	Separate	Lincoln Creek (to Menomonee River)	TSS, P, N
W. Euclid Av, W. Oklahoma Av, S. 39th St, S. 40th St	3,000	15,000	67,320	Separate	Kinnickinnic River	TSS, P, N
W. Appleton Av, W. Congress St, W. Hope St, W. Potomac Av	2,800	14,000	62,832	Separate	Lincoln Creek (to Menomonee River)	TSS, P, N
W. Hadley St, W. Locust St, N. 81 st St, N. 82 nd St	2,400	12,000	53,856	Separate	Menomonee River	TSS, P, N
W. Hope Av, W. Marion St, N. 61 st St, N. 62 nd St	2,400	12,000	53,856	Separate	Lincoln Creek (to Menomonee River)	TSS, P, N
W. Center St, W. Clarke St, N. 55 th Pl, N. 56 th St	2,940	11,025	49,480	Separate	Lincoln Creek (to Menomonee River)	TSS, P, N
TOTALS	22,340	105,825	474,942			

Milwaukee's Greenscape Green Alleys will improve water quality and deliver Great Lakes protection through a targeted reduction in total suspended solids (TSS), nitrogen (N) and phosphorous (P) released into Milwaukee's tributaries and rivers. The proposed green alleys will capture and infiltrate approximately 474,942 gallons of stormwater runoff onsite, filtering TSS, N and P before ultimately draining to a nearby waterway. Milwaukee's green alleys will provide direct pollutant removal and reduce stormwater runoff from entering Milwaukee's impaired waterways including the Kinnickinnic, Menomonee and Milwaukee Rivers that flow to the Milwaukee Estuary Area of Concern and into Lake Michigan. In addition to direct pollutant removal, Green Alleys will remove total volume from the

separate storm sewer system, relieving pressure during extended rain events and reducing the risk of stormwater flooding.

The City's approach to green alleys that installs 4 feet of porous pavement in the center alley lane is more cost-effective than the full use of porous pavement, yet does not jeopardize the durability and longevity of the alley. Using this successful model, expansion of the City's green alleys is the next step. Replication of this model beyond Milwaukee is also practical and feasible. The existing model demonstrates that the porous center lane avoids much of the vehicle wear and tear, with the primary wear pattern falling on the conventionally-paved areas. The proposed locations will remain in green infrastructure and maintained for a minimum of 15 years. The *Green Streets Stormwater Management Plan* includes a list of routine maintenance activities that will be performed to ensure long-term performance of green infrastructure. The City will vacuum sweep the green alleys twice annually to maintain proper drainage and infiltration. Additionally, City inspectors will perform annual site inspections to record durability and longevity and to confirm the green alleys are performing as designed.

The City will install 7 green alleys with porous pavement at a cost of \$680,000 with the City base cost of \$864,000. The City will perform the engineering, design and inspection of green alleys and contract for project installation.

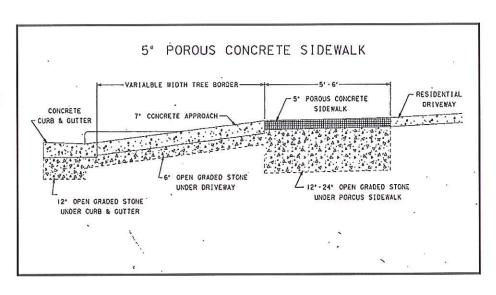
Porous Walks

The City continues to explore the multi-faceted role of green infrastructure within an urban context where large-scale applications may be limited by space and cost. *Milwaukee's Greenscape* recognizes possibilities for green infrastructure exist beyond traditional applications and includes small-scale approaches. Small-scale applications of green infrastructure have potential to deliver cost-effective, replicable results when implemented creatively and in conjunction with existing work. *Milwaukee's Greenscape* will implement small-scale green infrastructure solutions by installing porous concrete sidewalks in conjunction with street reconstruction and paving improvements to address stormwater runoff in a cost-effective manner.

Specifically, *Milwaukee's Greenscape* will demonstrate the use and application of porous concrete sidewalks as an effective stormwater management tool to address water quality and water quantity issues facing Milwaukee. To capture stormwater runoff from residential properties, approximately 3,400 ft² of porous walks will replace existing public sidewalk located between the driveway and driveway approach to capture polluted stormwater runoff that would otherwise drain to the street and into the storm sewer system. The City will undertake this work during planned street reconstruction projects that require removal and replacement of street, sidewalk and curb and gutter. This approach takes advantage of mobilization, materials and labor efficiencies offered through street reconstruction projects to reduce the typically higher costs of green infrastructure solutions.

The City of Milwaukee is uniquely positioned to lead the way in demonstrating porous sidewalks in the Great Lakes region. While demonstrated as effective in other parts of the country, *Milwaukee's Greenscape* will feature pre-fabricated porous concrete to reduce the problem of premature failure, often a result of weather and human error. Pre-fabrication offers the benefit of a controlled environment during the manufacturing process. In this way, each porous sidewalk segment is consistent. The City is currently partnering with the Fund for Lake Michigan on a pilot demonstration of porous walks on two 2013 street reconstruction projects. One is located on Edison Street between Juneau and Highland Avenues situated along the Milwaukee River in downtown Milwaukee, the second is located on 72nd Street between Locust and Burleigh Streets. The City will use the lessons learned from this pilot demonstration and apply them to the 2014 installations.

This project will install approximately 3,400 ft² of porous concrete walks at 68 properties. The porous concrete walk segments will replace existing concrete sidewalk located between the driveway and the driveway approach. Installation of each porous walk segment includes 2 feet of open-graded stone to promote infiltration and under-drains to redirect



excess stormwater to existing street catch basins in extreme rainfall events. The use of under-drains is a strategy to keep pavement dry in the late fall and early spring when the freeze/thaw cycle can cause damage from frost that could lead to pre-mature pavement failure. Milwaukee's high clay content soils can hinder infiltration and the use of under-drains can help to ensure long-term porous pavement performance.

Milwaukee's Greenscape Porous Walks include:

Sidewalk Location	# of Driveways	Porous Pavement Area (ft²)	Storage Volume (gallons)	Sewer System	Water Body	Pollutant Removal
S. Pinecrest – N. Story Pkwy to N. 49 th St	34	1,700	6,333	Separate	Menomonee River	TSS, P, N
N. 39 th St – W. Concordia Av to W. Keefe	17	850	3,815	Separate	Lincoln Creek (to Kinnickinnic River)	TSS, P, N
W. Crawford Av - S. 45 th to S. 47 th St	11	550	2,468	Separate	Wilson Park Creek (to Kinnickinnic River)	TSS, P, N
S. Griffen Av - E. Morgan Av to E. Holt Av	6	300	1,346	Separate	Kinnickinnic River	TSS, P, N
TOTALS	68	3,400	13,962			

The City's use of porous walks is an innovative approach to stormwater management as it targets the segment of sidewalk that captures runoff from residential driveways that would otherwise drain to the street and into the separate storm sewer. This is the first known application of porous sidewalks using this targeted approach in conjunction with pre-fabricated porous concrete materials. By installing porous walks abutting driveways, stormwater runoff infiltrates into the underground storage layer where it is absorbed and pollutants are filtered. The proposed porous walks will capture approximately 13,962 gallons of stormwater runoff from nutrient-laden lawns, keeping TSS, P and N out of Lake Michigan. Targeting driveway segments for porous walk replacement rather than the full length of sidewalk achieves a balanced solution to stormwater management that is both cost-effective and environmentally sustainable.

Porous Walks is a replicable model that can be transferred to other communities within the Great Lakes region and nationally. The proposed locations will remain in green infrastructure and maintained for a minimum of 15 years. Routine sidewalk maintenance such as general cleanliness, leaf collection and snow and ice removal is the responsibility of the adjacent property owner. The City will provide property owners with information on the benefits of porous sidewalks and instructions on materials to avoid that could reduce porous pavement effectiveness (i.e. sand). Additionally, city inspectors will perform annual site inspections to record durability and longevity and to confirm the porous walks are performing as designed. Should a performance problem occur, the City will coordinate with the property owner to perform power washing of the porous walk.

The City will install 68 porous walks at 4 locations using pre-fabricated porous concrete at a pavement cost of \$220,000 with the City base cost of \$690,000. The City will perform the engineering, design and inspection of porous walks and contract for project installation.

Stormwater Parking

Milwaukee's Greenscape proposes to install a stormwater parking lot at the City of Milwaukee Central Garage located at 2142 W. Canal Street to include 3,125 ft² of porous pavement to reduce stormwater runoff and improve water quality of the Menomonee River. The stormwater parking installation is an opportunity to demonstrate the use of porous pavement in a high-trafficked "industrial-like" setting and showcase a broad spectrum of green infrastructure applications. The porous pavement installation is above and beyond WPDES permit requirements and the facility is in compliance with the City's Stormwater Pollution Prevention Plan.

The City's Central Garage serves as the primary repair facility for a fleet of 2,000+ vehicles. The facility services both heavy-duty specialized equipment and light-duty passenger cars and pick-up trucks. The facility includes a large surface parking lot that stores vehicles and equipment on both a short and long-term basis. Vehicles are parked outdoors on arrival and are transferred indoors for repairs. Vehicles and equipment used on a seasonal basis are also stored outdoors to facilitate repair operations. The grounds are secured with perimeter fencing. Located on the southern banks of the Menomonee River, a portion of the Hank Aaron State Trail operated by the Wisconsin Department of Natural Resources is directly adjacent to the facility. The northwest corner of the outdoor surface lot is a combination of patch asphalt and rough gravel that is uneven and filled with pot holes. This segment of the lot can experience stormwater flooding following heavy or prolonged rains with stormwater collecting at low points along the parking lot.

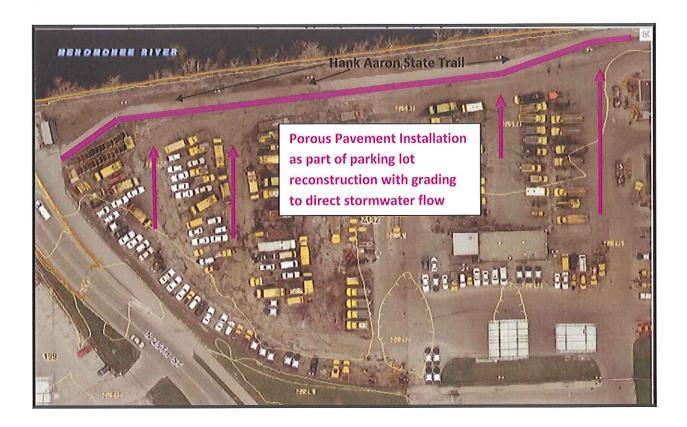
Milwaukee's Greenscape Stormwater Parking includes installation of approximately 3,125 ft² of porous pavement along the northern perimeter of the parking lot as part of the overall reconstruction of the parking lot. The reconstruction of the Central Garage parking lot provides the opportunity to incorporate a green infrastructure solution to correct the stormwater flooding problem, as well as address stormwater runoff from the entire site. The parking lot will be graded to redirect stormwater runoff from the site to drain to the porous pavement installation. Stormwater Parking will capture and infiltrate 14,025 gallons of stormwater onsite and improve the functionality of the facility and ease fleet repair operations.

Milwaukee's Greenscape Stormwater Parking includes:

Parking Lot Location	Porous Pavement Area (ft²)	Storage Volume (Gallons)	Water Body	Pollutant Removal
Central Garage 2142 W. Canal St	3,125	14,025	Menomonee River	TSS, P

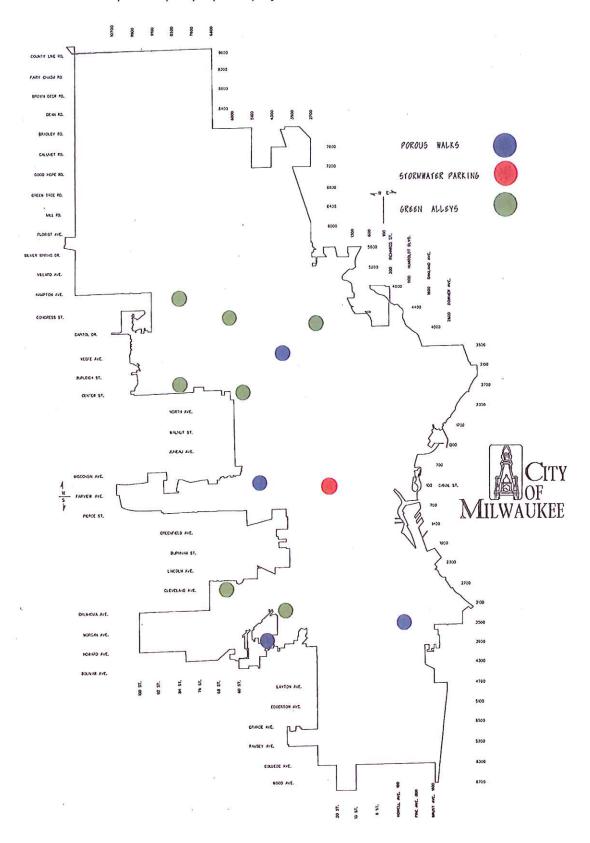
Stormwater Parking will remain in green infrastructure and maintained for a minimum of 15 years. The City will vacuum sweep the Stormwater Parking porous pavement twice annually to maintain proper drainage and infiltration. Additionally, city inspectors will perform annual site inspections to record durability and longevity and to confirm the porous pavement is performing as designed.

Stormwater Parking will install porous pavement at a cost of \$100,000 with the City cost for lot reconstruction totaling \$566,000. The City will perform the engineering, design and inspection and contract for project installation.



Milwaukee's Greenscape- Green Alleys, Porous Walks and Stormwater Parking advances the use and practice of green infrastructure into city operations and demonstrates innovative, cost-effective approaches to reduce the cost of porous pavement. It achieves tangible water quality benefits by reducing stormwater runoff and filtering pollutants to protect the health of the Great Lakes.

Milwaukee's Greenscape - map of proposed projects:



Project Partners

Integral to *Milwaukee's Greenscape*, the City will engage the public through outreach and education and in collaboration with project partners. *Milwaukee's Greenscape* will feature public participation at the project level with the installation of green alleys and porous walks. Residents who live in the neighborhoods and on the blocks with green infrastructure installations will receive direct mail information about the projects and the water quality features and benefits. The City will also host community meetings with residents at each project location to notify them of the reconstruction projects. The City will provide detailed information about the projects including the overall scope, the green infrastructure components, water quality benefits, project timelines and costs. City project staff will hear from residents about their concerns and the public will ask questions with the desired result of improved project design and installation and increased resident satisfaction. These meetings will involve the local elected Alderperson representing the area to ensure full transparency and communication across city departments.

In addition, the City will partner with MMSD and Sweet Water, the Southeastern Wisconsin Watersheds Trust, Inc. to broaden outreach across the region and demonstrate the City's leadership on green infrastructure. MMSD will host *Milwaukee's Greenscape* on www.h2ocapture.com, a green infrastructure website that serves as a forum to highlight regional efforts to reduce stormwater runoff and protect Lake Michigan. Also, MMSD will invite the City to share the innovative approaches proposed in *Milwaukee's Greenscape* at their Technical Advisory Team (TAT) meetings. MMSD holds monthly TAT meetings with the 28 communities within their service area to share stormwater best management practices. These meetings promote the technical transfer of ideas and information and provide valuable peer-learning opportunities. These opportunities will allow the City to demonstrate the innovation of these approaches and the feasibility of green infrastructure that can stimulate further green infrastructure investment in Southeast Wisconsin and across the Great Lakes region.

The City will expand its existing partnership with Sweet Water, a regional collaborative working to improve water quality in the five watersheds of Greater Milwaukee. Milwaukee's Greenscape is an example of the kind of watershed-wide innovation and cooperation promoted by Sweet Water. This initiative aligns well with existing efforts led by Sweet Water including the Menomonee River Watershed-Based Permit, a region-wide \$260,000 public awareness campaign on the harm caused by nonpoint source pollution and Total Maximum Daily Load (TMDL) baseline work. The proposed green infrastructure approaches can be transferred to other municipalities within the SE Wisconsin region through information and resource sharing already established under the watershed-based permit structure. Additionally, Sweet Water can heighten the success of the City's green infrastructure efforts through the combined work of its nonprofit partners. Operating under a multi-year \$360,000 grant from the Joyce Foundation, Sweet Water has working green infrastructure partnerships with American Rivers, the Sixteenth Street Community Health Center, Clean Wisconsin, Midwest Environmental Advocates and Milwaukee Riverkeeper who can promote the City's innovative green infrastructure approaches into their existing work. Finally, partnership with Sweet Water offers the City an important opportunity to promote regional green infrastructure efforts and lessons nationally. Already a promoter of green infrastructure efforts in Milwaukee, with its well-attended annual Clean Rivers Clean Lake

Conference and other forums, Sweet Water representatives are active in promoting innovative approaches at statewide and national events such as the annual conferences of River Network, Land Trust Alliance, Healing our Waters and the Clean Water America Alliance. The City's Milwaukee's Greenscape efforts will be shared across a variety of national water quality forums. Working together, the progress made using green infrastructure in the area has national implications for adaptation and replication across the Great Lakes and the country.

Budget Narrative

The City of Milwaukee will use federal funds to install 28,865 ft² of green infrastructure including green alleys, porous walks and stormwater parking. The requested \$1,000,000 federal funds will cover the porous pavement cost only. The City will provide \$2,120,000 in match funds for project engineering, design and construction. The City will perform engineering, design and inspection of the green infrastructure and contract for project installation. The City will perform project management, outreach, coordinate with project partners and issue a final report to the US EPA as part of the project.

Milwaukee's Greenscape – Green Alleys, Porous Walks and Stormwater Parking budget details include:

Green Infrastructure	Federal Share	City Share	Total
Green Alleys:			
W. Cleveland Av, W. Freemont Pl, S. 63 rd St, S. 67 th St	\$130,000	\$105,000	\$235,000
W. Capitol Dr, W. Hope Av, N. 24 th Pl, N. 25 th St	\$135,000	\$170,000	\$305,000
W. Euclid Av, W. Oklahoma Av, S. 39 th St, S. 40 th St	\$90,000	\$115,000	\$205,000
W. Appleton Av, W. Congress St, W. Hope St, W. Potomac Av	\$85,000	\$184,000	\$269,000
W. Hadley St, W. Locust St, N. 81st St, N. 82nd St	\$75,000	\$90,000	\$165,000
W. Hope Av, W. Marion St, N. 61 st St, N. 62 nd St	\$75,000	\$90,000	\$165,000
W. Center St, W. Clarke St, N. 55 th Pl, N. 56 th St	\$90,000	\$110,000	\$200,000
Porous Walks:			
S. Pinecrest – N. Story Pkwy to N. 49 th St	\$110,000	\$265,000	\$375,000
N. 39 th St – W. Concordia Av to W. Keefe	\$55,000	\$200,000	\$255,000
W. Crawford Av - S. 45th to S. 47th St	\$35,000	\$150,000	\$185,000
S. Griffen Av - E. Morgan Av to E. Holt Av	\$20,000	\$75,000	\$95,000
Stormwater Parking:			
Central Garage - 2142 W. Canal St	\$100,000	\$566,000	\$666,000
TOTALS	\$1,000,000	\$2,120,000	\$3,120,000